



Federal Aviation Administration

Memorandum

JAN 17 2008

Date:

From: Manager, Airplane Certification Office, ASW-150

To: Manager, Small Airplane Directorate, ACE-100

Prepared by: Patrick Massie, Aerospace Engineer, ASW-150

Subject: Review and Concurrence, Equivalent Level of Safety (ELOS) to 14 Code of Federal Regulations (CFR), part 23, §23.1353(h), Amendment 23-49, Finding No. ACE-07-17

This memorandum requests that your office review and provide concurrence with the proposed finding of Equivalent Level of Safety (ELOS) in accordance with § 21.21(b)(1), to the requirements of § 23.1353(h) for the battery installation in the Quartz Mountain Aerospace (QMA) airplane Model 11E.

STATEMENT OF ISSUE:

The Quartz Mountain Aerospace Model 185-11E airplane was type certificated for day Visual Flight Rules (VFR) operations in 2002. The airplane was certified with a single electrical storage battery, Teledyne Gill Model G-247. QMA has applied for an amended type certificate (ATC) that will authorize night and Instrument Flight Rules (IFR) operations with this airplane, but not to include flight into icing conditions. Since the starter battery is being used to show compliance to 14 CFR, part 23, § 23.1353(h), Amendment 23-49, an ELOS compliance finding is required.

DISCUSSION:

The model 185-11E is a four-place airplane, certified in normal category only. A single piston engine and a fixed-pitch propeller drive the airplane. Night and IFR operations with this airplane will require a continuous source of electrical power in order to maintain safe flight. Many of these airplanes are intended to be flown by trainees and by low-time private pilots.

The main electrical system operates on 24 VDC power, generated by a starter generator mounted on the engine. One dry-charged lead acid battery (16 AH) is installed to provide power to start engine (in the event that an electrical ground power unit is not available), while still providing at

least 30-minutes of power to the critical electrical equipment (in the event the starter-generator fails in flight).

APPLICANT'S POSITION:

The Gill G-247 battery in the existing design has a 30-minute emergency rating of 32 amps. At 24 amperes (75% of 32 amps), the battery has sufficient capacity to power the essential night-and-IFR loads for 30 minutes. Also, the applicant will make additional safety provisions to ensure a level of safety that meets the intent of 14 CFR, part 23, § 23.1353(h), Amendment 23-49.

Compensating Features:

1. The airplane flight manual (AFM) will prohibit takeoff into night or Instrument Meteorological Conditions (IMC) unless the battery is at 75%, or greater charge (Ammeter reading at 75% charge and nominal voltage reading will be determined by testing).
2. There is an alternator caution light in the cockpit to ensure that the pilot will quickly recognize an alternator failure.
3. The airplane flight manual will instruct the pilot as to which electrical loads to shed in the event of an alternator failure.
4. When the Gill G-247 battery is charged to 75% or more, its rated capacity will be large enough to sustain the essential electrical loads of the airplane for the required 30 minutes (to be validated by test.)
5. To ensure continued airworthiness of the battery, the airplane's maintenance manual (in Section 4) will require inspection and servicing in accordance with Teledyne-Gill TBP 1560, Revision E dated 06/09/2005, airworthiness limitations. These battery manufacture's instructions will be included in the Model 11E Maintenance Manual, Section 4, Airworthiness Limitations.

FAA POSITION:

The requirements of § 23.1353(h) are as follows:

“In the event of a complete loss of the primary electrical power generating system, the battery must be capable of providing at least 30 minutes of electrical power to those loads that are essential to continued safe flight and landing. The 30 minute time period includes the time needed for the pilots to recognize the loss of generated power and take appropriate load shedding action.”

Previous guidance on this issue states the airplane's primary electrical power includes the airplane's electrical generation system and the airplane's starter battery, when only one battery is installed. The battery for the 30-minute criteria; therefore, should be an independent power source from the airplanes starter battery. If adequate monitoring and procedures are incorporated, so the pilot knows the airplanes starter battery meets the 30-minute criteria after an

engine start and during all other operations, an ELOS finding may be an acceptable method for using the airplanes starter battery. Please refer to the guidance in AC 23.1309-1C, “Equipment, Systems, and Installations in part 23 Airplanes,” for determining the loads that are essential to continued safe flight and landing. Continued safe flight and landing is defined as follows:

“This phrase means that the airplane is capable of continued controlled flight and landing, possibly using emergency procedures, without requiring exceptional pilot skill or strength. Upon landing, some airplane damage may occur as a result of a failure condition.”

The 30-minute power bus should include all systems that could cause a catastrophic failure condition under the § 23.1309, Failure Hazard Assessment (FHA). Sometimes, it may not be practical to include all systems on the 30-minute power bus that could cause a catastrophic failure condition. For example, systems with large heating loads for ice protection may not be included on the 30-minute electrical power bus; however, the possible hazards that could cause catastrophic failure conditions should be minimized.

To minimize the hazard, either is to reduce, lessen, or diminish to the least practical amount with current technology and materials. The least practical amount is that point at which the effort to further reduce a hazard significantly exceeds any benefit in safety gained from that reduction. Additional efforts would not result in any significant improvements to safety and would inappropriately add to the cost of the product.

Assuming operations under IFR conditions for part 91, the following systems should be included on the 30-minute power bus:

- If needed to comply with § 23.1325, one airspeed indicator and altimeter with a heated pitot tube and heated static pressure source or an alternate source of static pressure;
- The magnetic compass, and any display necessary for continued safe flight and landing, sufficiently illuminated for night operation;
- One navigation system installation appropriate to the ground facilities to be used;
- One communication installation system;
- One gyroscopic pitch and bank indicator;
- One clock;
- Any display for the powerplant parameter necessary for continued safe flight and landing; and any electrical loads unique for the airplane characteristics and needed for continued safe flight and landing for the intended operations.

Tests and analyses should be considered for determining the rated operating capacity of the battery, the normal service life, and the continued airworthiness requirement of § 23.1529. For these tests and analysis, the following should be established as follows:

- (1) For the operating capacity: the current discharge rate, nominal charging voltage, end point voltage, etc.; and

(2) For the airworthiness requirement: the inspection schedule, useful battery life, end of life, etc.

RECOMMENDATION:

Based on the Quartz Mountain showing of Compensating Features of their design (per Advisory Circular 23-17B), the Federal Aviation Administration (FAA) concurs with the issuance of an ELOS for 14 CFR, part 23, § 23.1353(h), Amendment 23-49.

The FAA additionally notes that there is a voltmeter and ammeter that allows the pilot to monitor voltage and current. As part of the ELOS, Quartz Mountain will identify the values for current and voltage that correlate with the 75% state of charge. The values will be identified as limitations in the AFM and shown as warning by marker, color, and/or flashing.

CONCURRENCES:

Michele M. Owsley
Manager, Airplane Certification Office, ASW-150

12-17-07
Date

Patrick Mullen for
Manager, Standards Office, ACE-110

1-10-08
Date

for James E. Jackson
Manager, Small Airplane Directorate, ACE-100

1-17-08
Date